Bandwidth Enhancement of Microstrip Patch Antennas using Parasitic Element

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ABSTRACT- In this paper we present a proposed design for rectangular micro strip patch antenna using multiple number of parasitic elements along the edges of microstrip patch. Using proposed antenna design and coaxial probe feeding at proper position, we will compare the resultant bandwidth with the previous results of normal rectangular, single and double parasitic elements. We are using IE3D simulation software for designing and analysis. We have observed that using multiple parasitic elements and using coaxial probe feeding at proper location we can get better bandwidth.

Key words: Normal rectangular Microstrip patch antenna; parasitic elements; bandwidth; VSWR; return loss; comparison of normal shaped and antenna using parasitic elements**.**

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INTRODUCTION

Microstrip antenna plays a major role in wireless communication. It has many advantages such as low profile, compactness, easy to fabricate, easy installation, low cost etc but it has a major disadvantage of narrow bandwidth which proved to be a challenge for engineers to meet high data rate for various broadband application. bandwidth of antenna can be increased by various method such as by using the parasitic elements along side of the patch antennas, by increasing the thickness of substrate with low dielectric constant, by probe feeding, by cutting slot and by different shape of antenna .By probe feeding and moving the location of probe feeding we get optimized bandwidth. The Increased bandwidth is compare with bandwidth of normal patch antenna and bandwidth of microstrip antenna having single and double parasitic element. We will analyse that there is increase in bandwidth using proposed antenna and using coaxial probe feed at position where maximum matching is obtain. Simulation of all patch antennas has been carried out using IE3D software. In normal rectangular patch antenna bandwidth enhanced up to 15.51%, by using compact E-shaped patch antenna used in previous works bandwidth increased up to 7% [2] by DSP algorithm, in my proposed work by using IE3D simulator we increase bandwidth 28.57% at probe location (24mm×45mm), which gives somewhat better result, and normal rectangular patch improve bandwidth is 15.51% at probe location (24.2mm× 45mm).

ANTENNA DESIGN

The proposed antenna is design using multiple parasitic patch along the edges of rectangular patch as shown in fig 4. In this paper ground plane is of (50mm X 50mm) and patch is of (40mmX 40mm).In normal rectangular patch without any parasitic element bandwidth is 15.51% at the probe location (24.2X 45),gain is 2.69.directivity is 5.36 and VSWR is 1.85.In single parasitic element bandwidth is 22.66% ,gain is 2.83.directivity is 6.04,VSWR is 0.84.In double parasitic element bandwidth is 26.56%,gain is 4.33,directivity is 5.77,VSWR is 0.68. In proposed antenna with three parasitic elements bandwidth is 28.57% at the probe location (24X 45).Gain is 3.08.directivity is 5.44,VSWR is 0.87 and antenna efficiency is 93.6%.

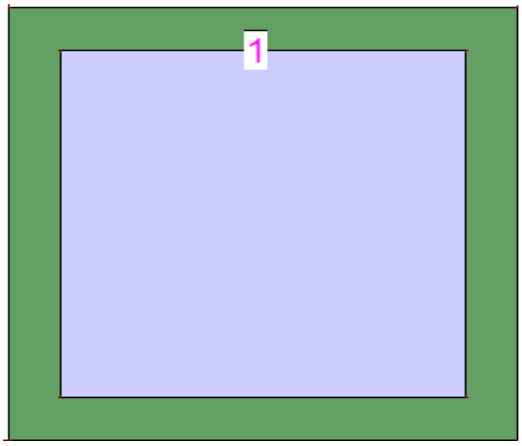


Figure (1): Normal square Microstrip Antenna

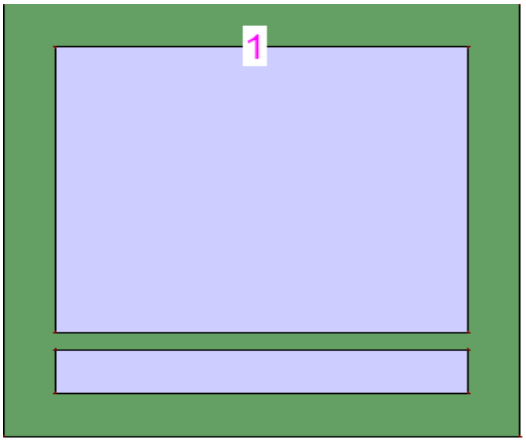


Figure (2): Single parasitic element Microstrip Antenna

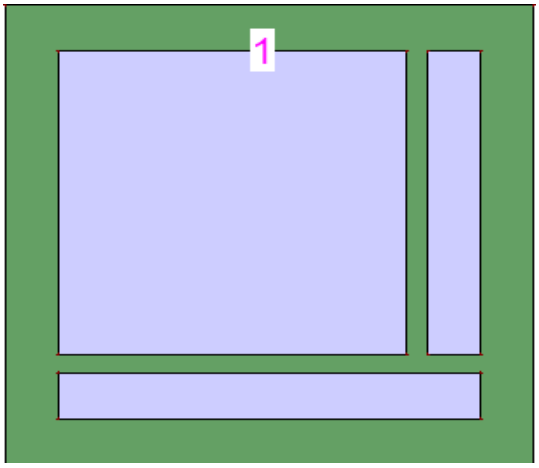


Figure (3): Double parasitic element Microstrip Antenna

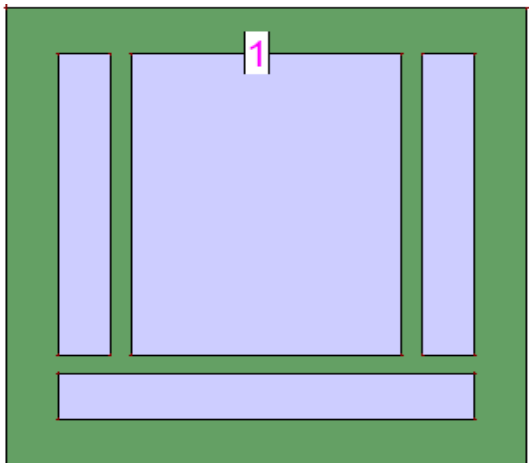
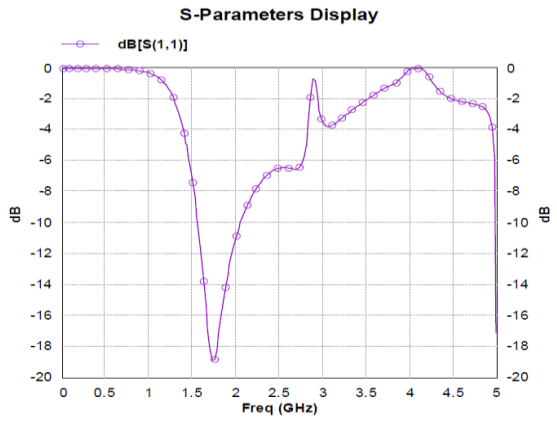


Figure (4): Figure of Proposed Antenna

ANTENNA RESULT

We are using IE3D simulation software for simulation of microstrip patch antenna [4]. The bandwidth of proposed antenna on simulation comes out to be 28.57% at 1.57GHz resonance frequency and the Return loss (S_{11}) of proposed patch antenna has -18.88db at the 1.57GHz resonant frequency, and normal square patch antenna has improve bandwidth 15.51%at the 1.61GHz resonant frequency, normal antenna has Return loss (S_{11}) of -12.57db. The band width is calculated at the frequency range where the return loss (S_{11}) is approximately -10 or below [1]. The return loss of proposed microstrip patch antenna is shown in figure (5). The return loss of the normal antenna is shown in figure (6). The plot the result of the VSWR at the resonant frequency and VSWR value is observed as ≤ 2 improved matching conditions, VSWR, directivity, gain, antenna and radiation efficiency are shown in figure (7-10).



Figure(5): Return loss Vs Frequency for proposed antenna

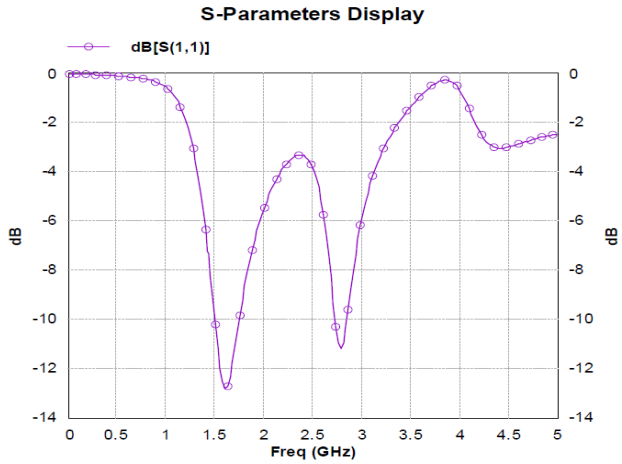


Figure (6): Return loss Vs Frequency for normal square shaped antenna antenna

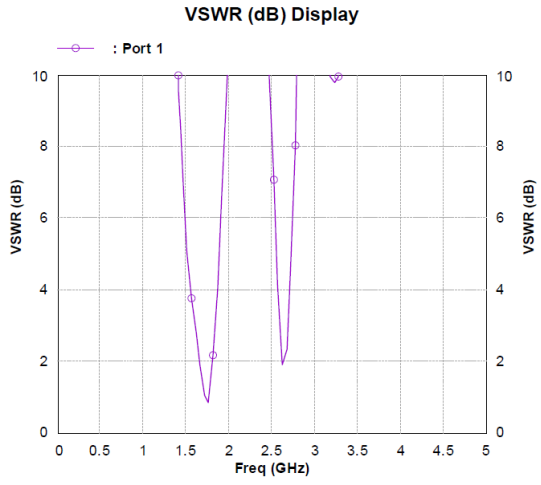


Figure (7):VSWR Vs Frequency for proposed antenna

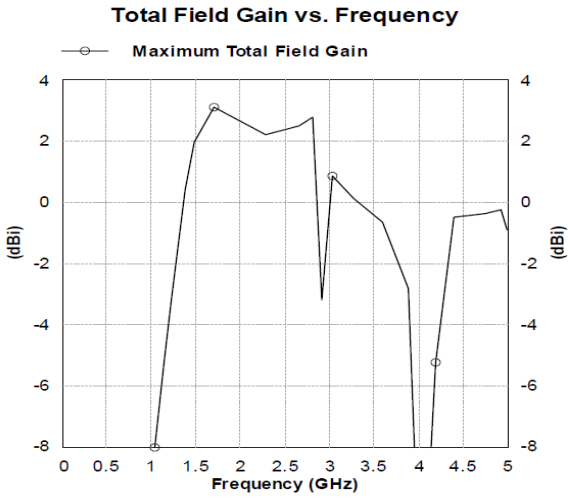


Figure (8): Gain Vs frequency for the proposed antenna

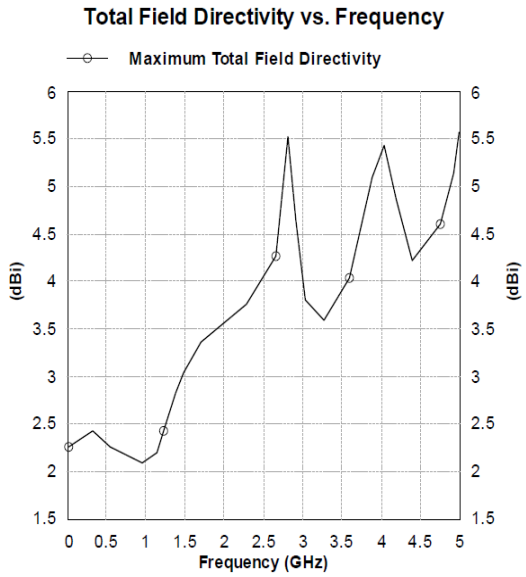


Figure (9): Directivity Vs Frequency curve for proposed antenna

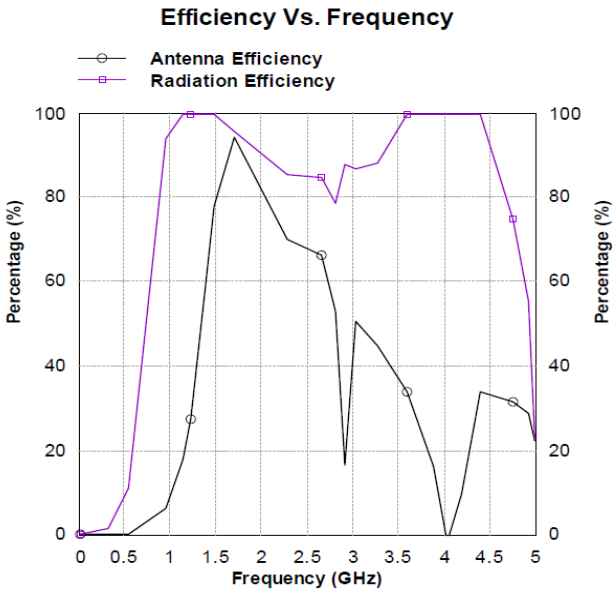


Figure (10): Antenna and Radiation efficiency of proposed antenna

COMPARISION

As we see in previous work that are based on DSP algorithm and various work that cutting the shapes of microstrip patch antenna, varying thickness, dielectric constant. In our proposed work we are using IE3D simulator and by using multiple parasitic elements gives better bandwidth and more efficient results figure (5). Comparison to normal square shape patch antenna and proposed antenna , square shaped has improve bandwidth 15.51% at the 1.57GHz resonant frequency and my proposed antenna is improve bandwidth 28.57% at 1.61GHz resonant frequency.

CONCLUSION

We can analyse that by using different shape, feeding techniques, notches, slots, parasitic , elements we can achieve modified bandwidth. The antenna band width is increased up to 28.57% and it resonates at 1.61GHz resonance frequency. Along with band width antenna directivity, efficiency and radiation pattern also improved, the proposed antenna has high bandwidth which can be used for wireless communication of high data rate. Compared with normal square shaped patch antenna whose impedance bandwidth is 15.51% and for our proposed antenna whose impedance bandwidth is 28.57%.

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